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USER MANUAL

PRECISION ABSOLUTE MANOMETER

The Precision Absolute Manometer is a microprocessor based pressure sensing device used to directly measure pressure relative to absolute zero. Model HHP360-A measures pressure from 0 – 17.403 PSIA and model HHP360-B measures pressure from 0 – 38.674 PSIA. Pressure can be displayed in a variety of English and S.I. engineering units. All HHP360s include a Tare function, a Min/Max function, selectable damp rates and altitude displayed in feet or meters. The HHP360 can also display barometric pressure corrected to sea level.

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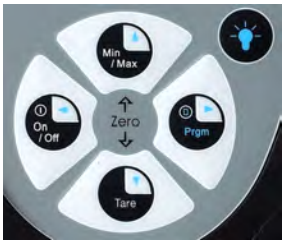
User Interface



1. Keypad Functions

ON/OFF & BACK ▲ KEY

Turns the manometer on and enters the unit into the **Measure Mode.** Pressing the key while in the **Measure Mode** turns the unit off. It also serves as a backspace key when editing in the **Program Mode.** The ◀ key takes the user out of a programmable register without changing the previous setting. Pressing this key repeatedly will return the user to the **Measure Mode** and then shut off the manometer.

MIN/MAX & UP ▲ KEY

In the **Measure Mode** activates the **Min/Max** function of the manometer. When activated the minimum value is displayed on the upper left of the display and the maximum value on the upper right. This key also deactivates and resets this function. The ▲ key is used to scroll through the programmable registers when the unit is in the **Program Mode**. Once a programmable register is selected the ▼ key can be used to edit that register.

TARE & DOWN ▼ KEY

In the **Measure Mode** toggles on/off the **Tare** function. The **Tare** function is designed to set the display value to "0". With **Tare** activated, the letter "**T**" appears in the lower left of the display. The ▼ key is used to scroll through programmable registers with the unit in the **Program Mode**. Once a programmable register is selected the ▼ key can be used to edit that register.

PRGM & ENTER ▶ KEY

Puts the manometer into the **Program Mode** from the **Measure Mode**. When in the **Program Mode**, pressing this key selects the programmable register to be edited (with prompt for password if **Lockout** is set). After the register has been edited, pressing the

PRGM key enters the new setting into the manometer's non-volatile memory. This key also acts as a forward space ▶ key when editing user input such as the header name and user units.

BACKLIGHT KEY

The BACKLIGHT key, represented by the standard light bulb symbol, toggles the display backlight between green and off.

2. Zeroing the Manometer

The HHP360 is a stable and precise instrument. However, on occasion the handheld should have a new zero taken. This is done to remove zero drift that can occur since it was last zeroed. The HHP360 can be zeroed only if the new applied zero is within ± 1% FS of the original factory calibration zero. This prevents accidental zeroing at atmospheric pressure or other relatively high pressures. If outside this limit a "ZERO RANGE ERROR" message appears and the manometer will not zero.

The HHP360 provides three mechanisms for re-zeroing:

1. **Referenced to Absolute Zero**: This traditional *and preferred* method takes a "snapshot" of the measured pressure when a vacuum of less than 100 microns Absolute is applied to the sensor.

2. **Factory Zero**: This method restores the calibration curve to the original zero taken at the factory. Note that this feature is intended for comparison purposes, and should not be used for real pressure measurement, as any zero-drift will not be compensated.

3. **User-Adjusted Zero**: This method allows the user to enter any pressure value when a known reference is applied (for example, the local barometer). The manometer will compare its actual measured value with the entered value, and calculate a new zero reference based on the offset.

1. To zero the manometer using **Referenced to Absolute Zero**, start with the unit turned **OFF** and use the following keystroke sequence:

Keystroke	Display
1. Press ON/OF button.	The display briefly shows the header name and full scale range of the unit in the last engineering units selected. The manometer then goes into the **Measure Mode** where the applied pressure and engineering unit of measure are displayed.
2. Connect the HHP360 to a vacuum source capable of a vacuum of 100 microns absolute pressure or less.	
3. Pull a full vacuum.	Display should read close to zero. (See note on next page)
4. Press MIN/MAX and TARE keys at the same time. (See figure 1 below.)	Top line of display reads "ZEROING SOURCE:" Bottom line of display reads "REF TO ABS ZERO"
5. Press the PRGM key.	Top line of display reads "ZERO IN PROGRESS" while bottom line counts down from 9. Zeroing is complete when unit returns to Measure Mode.

Figure 1

2. To zero the manometer using **Factory Zero**, start with the unit turn **ON** and in **Measure Mode** and use the following keystroke sequence:

Keystroke	Display
1. Press MIN/MAX and TARE keys at the same time. (See figure 1 above.)	Top line of display reads "ZEROING SOURCE:" Bottom line of display reads "REF TO ABS ZERO"
2. Press ▲or ▼arrow key until desired zero function is shown on the bottom line.	Bottom line of display reads "FACTORY ZERO"
3. Press the PRGM key.	Zeroing is complete when unit returns to Measure Mode.

NOTE: The HHP360 can be zeroed only if the new applied zero is within ± 1% FS of the original factory calibration zero. If outside this limit a "ZERO RANGE ERROR" message appears and the manometer will not zero. Contact the factory for support in this case.

3. To zero the manometer using **User-Adjusted Zero**, start with the unit turn **ON** and in **Measure Mode** and use the following keystroke sequence:

Keystroke	Display
1. Apply a known, accurate pressure source. This may be true atmospheric pressure, with known reference defined by a local barometer.	
2. Press MIN/MAX and TARE keys at the same time. (See figure 1 above.)	Top line of display reads "ZEROING SOURCE:" Bottom line of display reads "REF TO ABS ZERO"
3. Press ▲ or ▼arrow key until desired zero function is shown on the bottom line.	Bottom line of display reads "USER ADJ. ZERO"
4. Press the PRGM key.	Top line of display shows the current *non-zero compensated* pressure value. Bottom line of display shows the same value, along with the engineering unit.
5. Press any of ▲or ▼ arrow key or the PRGM key to begin editing. Example: set current pressure value to 29.5 In Hg @ 0° C.	Top line of display continuously updates. Bottom line of display data is ready for editing; the first digit is blinking.

6.	Press the ▲or ▼arrow key to set the first digit to 0. Using the UP arrow key the character sequence is 0 - 9, (-) negative, (.) decimal point. The (-) sign is used if your location is below sea level.	Current: xxx.xx 0xx.xx INHG
7.	When the digit is correct press the PRGM key. If an error is made use the back space τ key to move the cursor back to the incorrect digit. Press the UP▲ or DOWN▼arrow keys to display the correct value.	Cursor flashes to the right of "0".
8.	Continue this process until the display reads as shown at right.	Current: xxx.xx 029.50 INHG
9.	Press the PRGM key to enter the final digit.	Zeroing is complete when unit returns to Measure Mode.

Note that the User Adjusted Zero feature will not accept entries in altitude units (FEET or METERS). When the current engineering unit is FEET, the User Adjusted Zero function will automatically prompt for an entry in Inches of Mercury @ 0º C. When the current engineering unit is METERS, the User Adjusted Zero function will automatically prompt for an entry in Millimeters of Mercury @ 0º C.

3. Program Mode

The program mode is used to configure the manometer for Measure Mode operation. After the **PRGM** key is pressed in Measure Mode, the top line of the display reads “PROGRAM MODE”. The bottom line reads “UNITS SELECT”. Press the ▲ or ▼ arrow keys to scroll through the Program Mode to the desired register. The configurable registers found in the **Program Mode** are **Units Select, Damp Rate Select, User Info Select, Contrast Select, Sea Level Select, Data Logging, Leak Test and Exit**. Press the **PRGM** key to select any of these configurable registers. The manometer can be put into **Program Mode** at any time during Measure Mode operation by pressing the **PRGM** key. If Lockout is set, the correct code must be entered when prompted (see the User Info / Lockout section of this manual for more information on Lockout).

Units Select

The standard engineering units available on the HHP360 Precision Absolute Manometer are:

inches of Mercury at 0° C (in Hg @ 0° C)
millimeters of Mercury at 0° C (mm Hg @ 0° C)
PSI
milliBars (mBar)
Bars
kPa
Torr
Feet (Altitude displays)
Meters (Altitude displays)

To change the engineering units the manometer should be "ON" and in Measure Mode. Then follow these steps:

Keystroke	Display
1. Press the PRGM key.	**Top line reads "PROGRAM MODE" and bottom line reads "UNITS SELECT".**
2. Press the PRGM key.	**Top line reads "UNITS SELECT" and bottom line shows current engineering units.**
3. Press the ▲or ▼arrow key until desired engineering unit is displayed.	**Engineering units on bottom line of display change.**
4. Press the PRGM key to select the engineering unit.	**Top line reads "PROGRAM MODE" and bottom line reads "UNITS SELECT".**
5. Press the▼arrow key.	**Bottom line reads "EXIT".**
6. Press the PRGM key.	**Display returns to Measure Mode in new engineering unit.**

Displaying Altitude (US Standard Atmosphere 1962)

The model HHP360 is capable of displaying altitude in feet or meters based on U.S. Standard Atmosphere1962 tables. To set the unit to read out referenced to this altitude standard use the following steps:

Keystroke	Display
1. Press the PRGM key.	**Top line reads "PROGRAM MODE" and bottom line reads "UNITS SELECT".**
2. Press the PRGM key.	**Top line reads "UNITS SELECT" and bottom line shows current engineering unit.**
3. Press the ▲or ▼arrow key until "USER UNIT SELECT" is displayed.	**Top line reads "UNITS SELECT" Bottom line reads "FEET or METERS".**
4. Press the PRGM key.	**Top line reads "ALTITUDE SELECT". Bottom line reads "STANDARD".**
5. Press the PRGM key.	**Top line reads "PROGRAM MODE" and bottom line reads "UNITS SELECT".**
6. Press the ◀ key.	**Manometer returns to Measure Mode. Displays altitude referenced to US Standard Atmosphere 1962.**

Display User Defined Altitude

User Defined Altitude is useful in determining elevation change from a map elevation reference or from a survey trig marker elevation. To set up the HHP360 to display altitude based on user entered information, use the following steps:

Keystroke	Display
1. Press the PRGM key.	**Top line reads "PROGRAM MODE" and bottom line reads "UNITS SELECT".**
2. Press the PRGM key.	**Top line reads "UNITS SELECT" and bottom line shows current engineering unit.**
3. Press the ▲or ▼arrow	**Top line reads "UNITS**

key until "FEET" or "METERS" is displayed.	**SELECT"** **Bottom line reads "FEET or METERS".**
4. Press the PRGM key.	**Top line reads "ALTITUDE SELECT". Bottom line reads "STANDARD".**
5. Press the ▲arrow key once.	**Top line reads "ALTITUDE SELECT". Bottom line reads "REF. TO USER".**
6. Press the PRGM key.	**Top line reads "VALUE=: 00000000". Bottom line reads "CHANGE?: NO".**
7**.** If the value shown in step 6 is the correct altitude, press the **PRGM** key to accept and the ◀ key to return to Measure Mode. - **OR** - If the value shown in step 6 is not the correct altitude, press the▼key	**Top line reads "PROGRAM MODE" and bottom line reads "UNITS SELECT".** **Top line reads "VALUE=: 00000000". Bottom line reads "CHANGE?: YES".**
8. Press the PRGM key. Example: set altitude to 685 feet above sea level.	**Top line reads "USER MODE-FEET". Bottom line reads "00000000".**
9. Press the ▲or ▼keys to set the first digit to "6". Using the ▲key the provides the character sequence 0 - 9, (-) negative, and (.) decimal point. The (-) sign is used if your location is below sea level.	**Top line reads "USER MODE-FEET". Bottom line reads "60000000".**
10. When the digit is correct press the PRGM key. If an error is made use the back space ◀key to move the cursor back to the incorrect digit. Press the ▲ or ▼arrow keys to display the correct value.	**Cursor flashes to the right of the "6". Example: "60000000".**

11. Continue the process until the display reads as shown at right.	**Top line reads "USER MODE-FEET". Bottom line reads "685.0000".**
12. Press the PRGM key to enter the final value.	**Top line reads "PROGRAM MODE". Bottom line reads "UNITS SELECT".**
13. Press the ◀ key to return to Measure Mode.	**Top line reads "altitude referenced to 685". Bottom line reads "U 685 FEET".**

To set the unit to read in meters, select METERS from the UNITS SELECT menu. Then follow the same steps as outlined above.

Because the local barometer varies with weather conditions, the USER DEFINED ALTITUDE must be reentered each time the HHP360 is to be used in this mode. To adjust the unit to the current barometric pressure without changing the base altitude, select "NO" in step 6 in the table above by pressing the PRGM key. The HHP360 will display the current altitude referenced to prevailing local barometric pressure. To maximize accuracy the local altitude should be reset whenever better altitude information is available.

Pressure Corrected to Sea Level

Pressure reduction to Sea Level is required so that barometric readings can be compared at different elevations. The correction to sea level is done using a "hypsometric equation". This equation simulates a "fictitious column of air" which extends downward from the instruments location to sea level. This fictitious column is assumed to be similar to the actual air column over nearby lower elevations. Some properties are related to observed conditions while others must be assumed. Barometric pressures given by the National Weather Service and used at airports are always corrected to sea level.

To set the unit to display pressure corrected to sea level:

Keystroke	Display
1. Determine the elevation of the instrument above sea level, in meters. 700 meters will be used as an example.	
2. From Measure Mode press the PRGM key.	**Top line reads "PROGRAM MODE". Bottom line reads "UNITS SELECT".**
3. Press the ▲ or ▼ key until "SEA LEVEL SELECT" is displayed.	**Top line reads "PROGRAM MODE". Bottom line reads "SEA LEVEL SELECT".**
4. Press the PRGM key.	**Top line reads "SEA LEVEL SELECT". Bottom line reads either "ENABLE" or "DISABLED".**
5. Press the ▲ or ▼ key to indicate the correction to sea level status.	**Bottom line toggles between "ENABLE" and "DISABLED".**
6. To turn on the correction, set ENABLED on the 2nd line & press the PRGM key. **-OR-** To turn off the correction, set DISABLED on the 2nd line and skip ahead to step 12 .	**Top line reads "VALUE=: 00000000". Bottom line reads "CHANGE?: NO".**
7. To change the value press the ▲ key to toggle the display to "YES".	**Top line reads "VALUE=: 00000000". Bottom line reads "CHANGE?: YES".**

8. Press the PRGM key.	**Top line reads "SEA Top line reads "SEA LEVEL METERS". Bottom line reads "0̲0000000".**
9. Press the ▲or ▼arrow keys to set the correct value in the first digit.	**Top line reads "SEA LEVEL METERS". Bottom line reads "7̲0000000".**
10. When the value is correct press the PRGM key.	**Cursor moves over to the next digit.**
11. Repeat steps 9 and 10 above until the correct elevation is entered.	**Top line reads "SEA LEVEL METERS". Bottom line reads "7̲00.0000".**
12. Press the PRGM key to continue moving the cursor to the right. When the last digit is entered the unit will leave the sea level select mode and return to the Program Mode.	**Top line reads "PROGRAM MODE". Bottom line reads "UNITS SELECT".**
13. Press the ◀ key. The display will return to the Measure Mode. When the Correction to Sea Level is ENABLED, the display will have the letter "S" at the beginning of the 2nd line.	**Display reads; "S 803.1 TORR"**

Damp Rate Select

Adjustable exponential type damping is available to steady the display when measuring pulsating pressures. The HHP360 has a range of damping rates; 0.1, 0.2, 0.5, 1, 2, 5, 10, or 25 seconds. Damping is done by averaging new data from the pressure sensor against previously collected data. The microprocessor collects data from the sensor every 0.1 seconds. The display updates every 0.5 seconds, showing the current 0.1 second pressure reading. When set at 25 seconds, the display updates every 0.5 seconds with the average of the previous 25 seconds readings. Therefore, it takes up to 25 seconds from the time pressure is applied until the manometer displays the full scale applied pressure. Min/Max display updates every 0.1 seconds.

To set the damp rate:

Keystroke	Display
1. Enter Program Mode by pressing the PRGM key.	**Top line reads "PROGRAM MODE". Bottom line reads "UNITS SELECT".**
2. Press the ▲ key.	**Bottom line reads "DAMP RATE SELECT".**
3. Press the PRGM key.	**Top line reads "DAMP RATE SELECT". Bottom line shows current value.**
4. Press the ▲ or ▼ keys until the desire damp rate is displayed on the bottom line.	**Bottom line shows damp rate settings in seconds.**
5. Press the PRGM key.	**Top line reads "PROGRAM MODE". Bottom line reads "UNITS SELECT".**
6. Press the ▼ key.	**Bottom line reads "EXIT".**
7. Press the PRGM key.	**Returns to Measure Mode.**

User Info Select

The User Info Select registers are designed to provide the user with information on the hardware and software in the manometer. This register provides read only information on the sensor's serial number, software version and date of manufacture. It also allows the user to edit the Auto Shut-Off, Lockout and Start-Up Header Name features.

To access the User Info Select registers, follow the steps below. To configure a User Info Select register, follow the steps shown on the following page.

Keystroke	Display
1. From the Measure Mode press the PRGM key.	**Top line reads "PROGRAM MODE" and bottom line reads "UNITS SELECT".**
2. Press the ▲arrow key twice	**Bottom line changes to "USER INFO SELECT".**
3. Press the PRGM key.	**Bottom line shows serial number.**
4. Press the ▲arrow key.	**Software version number shown.**
5. Press the ▲arrow key.	**Manufacture date shown.**
6. Press the ▲arrow key. See instructions to set AUTO SHUT-OFF later in this manual.	**Top line reads "AUTO SHUT OFF" and bottom line reads "ENTER TO SELECT".**
7. Press the ▲arrow key. See instructions for using LOCKOUT later in this manual.	**Top line reads "LOCKOUT CODE" and bottom line reads "ENTER TO SELECT".**
8. Press the ▲arrow key. See instructions for editing the Header later in this manual.	**Top line reads "HEADER NAME" and bottom line reads "text". The cursor flashes at bottom left.**
9. Press the ◀arrow key to go back to "USER INFO SELECT" screen.	**Top line reads "PROGRAM MODE" and bottom line reads "USER INFO SELECT".**

Auto Shut-Off

Enabling the Auto Shut-Off feature allows the manometer to turn itself off after a user selected period of keypad inactivity. Selectable options include DISABLED, 10 Minutes (which is the factory shipped default), 20 Minutes, 30 Minutes, 45 Minutes and 60 Minutes. Disabling this feature limits the manometer to being turned off by using the ON/OFF key only.

To configure auto shut-off follow these steps:

Keystroke	Display
1. Follow steps 1-6 in the User Info Select table.	**Top line reads "AUTO SHUT-OFF" and bottom line reads "ENTER TO SELECT".**
2. Press the PRGM key, then the up or down arrow keys until the desired shut-off time is shown.	**Top line reads "AUTO SHUT-OFF" and bottom line toggles to "DISABLED", "10", "20", "30", "45" and "60" minutes .**
3. Press the PRGM key.	**Desired Auto Shut-Off time is selected, top line reads "AUTO SHUT-OFF" and bottom line reads "ENTER TO SELECT".**
4. Press the left arrow key three times.	**Returns to Measure Mode.**

Note: The "Auto Shut-Off" timer is suspended during Data Logging and Leak Test sessions to prevent accidental loss of information. Auto Shut-Off is re-instated after completion of Data-Logging or Leak Test sessions.

Lockout Select

Enabling the Lockout feature prevents unauthorized users from making changes to the configuration of the manometer. To enter the Program Mode, the user must first enter the "password" (two-digit Lockout Code) within approximately 40 seconds when prompted. Failure to enter the correct two digit code within approximately 40 seconds will return the unit to Measure Mode. Any two-digit numeric code can be programmed. The factory Lockout Code of 00 (which is the default as shipped from the factory) disables the Lockout.

To set the Lockout Code follow these steps:

Keystroke	Display
1. From the Measure Mode press the PRGM key. If the Lockout is set, enter the correct "password" when prompted.	**Top line reads "PROGRAM MODE" and bottom line reads "UNITS SELECT".**
2. Press the up arrow key twice.	**Bottom line reads "USER INFO SELECT".**
3. Press the right arrow key then the up arrow key four times.	**Top line reads "LOCKOUT CODE" and bottom line reads "ENTER TO SELECT".**
4. Press the right arrow key, then press the up or down arrow keys to change the first digit. Press the right arrow key to proceed.	**Bottom line shows the old Lockout Code. The cursor flashes at the first position while the value is changed, the cursor moves to the right position once the right arrow key is pressed.**
5. Press the right arrow key when the desired code is set. Lockout is activated.	**Top line reads "LOCKOUT CODE" and bottom line reads "ENTER TO SELECT".**
6. Press the left arrow key twice.	**Returns to Measure Mode.**

Header Name
Follow the steps below to edit the Header Name.

Keystroke	Display
1. From the Measure Mode press the PRGM key.	**Top line reads "PROGRAM MODE" and bottom line reads "UNITS SELECT".**
2. Press the up arrow key twice.	**Bottom line changes to "USER INFO SELECT".**
3. Press the PRGM key.	**Bottom line shows serial number.**
4. Press the up arrow key five times.	**Top line reads "HEADER NAME" and bottom line reads "text". The cursor flashes at bottom left.**
5. If header is correct press backspace key. If editing is desired proceed to step 7.	**Top line reads "PROGRAM MODE" and bottom line reads "USER INFO SELECT".**
6. Press the left arrow key.	**Returns to Measure Mode.**
7. Press the up or down arrow keys to set the correct alpha-numeric value.	**Displays a number between 0 and 9, a letter from A to Z, / or a blank space.**
8. Press the right arrow key to accept entry.	**Cursor advances one space to right.**
9. Repeat steps 8 and 9 until the desired Header is shown.	
10. If an error is made press the back arrow key until the cursor is over the incorrect value. Follow step 8 to correct. Press the right arrow key to advance the cursor without changing values.	
11. When the Header is complete press the PRGM key until header accepted.	**Top line reads "PROGRAM MODE" and bottom line reads "UNITS SELECT".**
12. Press the left arrow key.	**Returns to Measure Mode.**

Contrast Select

The Contrast Select register allows the user to adjust the character contrast of the LCD display to provide the best visibility for the ambient light conditions.

To adjust the contrast, follow these steps:

Keystroke	Display
1. From the Measure Mode press the PRGM key.	**Top line reads "PROGRAM MODE" and bottom line reads "UNITS SELECT".**
2. Press the ▲ key three times.	**Bottom line reads "CONTRAST SELECT".**
3. Press the PRGM key.	**Top line reads "CONTRAST SELECT". Bottom line shows a numerical value.**
4. Press the ▲ or ▼ keys to increase or decrease the contrast value. A low number gives maximum contrast and a high number gives minimum contrast.	**LCD lightens or darkens depending on the value set.**
5. Press the PRGM key.	**Top line reads "PROGRAM MODE" and bottom line reads "UNITS SELECT".**
6. Press the ◀ key.	**Returns to Measure Mode.**

If an error is made during the contrast adjustment, pressing the ◀ key returns the display to the previous contrast setting.

Data Logging

Data Logging can be used to record pressure measurements. Two record modes are supported: automatic and manual. In automatic mode, a pressure value is captured every 5 seconds for 20 minutes, resulting in 240 stored values. In manual mode, a pressure value is captured each time the PRGM key is pressed up to 240 values. The data collected during a logging session can be viewed upon completion.

Keystroke	Display
1. From the Measure Mode press the PRGM key.	**Top line reads "PROGRAM MODE" and bottom line reads "UNITS SELECT".**
2. Press the up arrow key five times.	**Bottom line reads "DATA LOGGING".**
3. Press the PRGM key.	**Top line reads "DATA LOGGING" and bottom line reads "RECORD".**
4. Press the PRGM key.	**Top line reads "RECORD MODE" and bottom line reads "AUTO" or "MANUAL".**
5. Press the PRGM key at AUTO to start automatic logging or at MANUAL to start manual logging mode.	**Top line reads "RECORDING X" and bottom line reads "XX.XX UNITS". AUTO records value every 5 seconds. Manual records value each time PRGM key is pressed.**
6. To stop recording values at any time, press the ◀ key.	**Top line reads "DATA LOGGING" and bottom line reads "RECORD".**
7. To access recorded values, press the ▲ key.	**Top line reads "DATA LOGGING" and bottom line reads "VIEW".**
8. To view recorded values, press the PRGM key.	**Top line reads "DATA LOG: 1" and bottom line displays the value. Continue pressing the ▲ key to view all values.**
9. Press the ◀ key 3 times.	**Returns to Measure Mode.**

The "Auto Shut-Off" timer is disabled for Data Logging sessions. Be sure to end the session to re-enable the Auto Shut-Off timer.

Leak Test

The Leak Test feature allows the user to determine the leak rate in the pneumatic system being monitored. Once configured, Leak Test monitors the measured pressure over time and displays the leak rate in the pressure units per minute at the conclusion of the test. The maximum configurable leak test period is 1440 min (1 day). Pressing any key during the leak test will abort the test.

To enable Leak Test follow these steps:

Keystroke	Display
1. From the Measure Mode press the PRGM key.	**Top line reads "PROGRAM MODE" and bottom line reads "UNITS SELECT".**
2. Press the down arrow key twice.	**Bottom line reads "LEAK TEST"**
3. Press the PRGM key.	**Top line reads "LEAK TEST" and bottom line reads "CONFIGURE".**
4. Press the PRGM key.	**Top line reads "Leak Test Period" & bottom "X.X MIN".**
5. Use the up, down & right keys to input test period	**Bottom line reads desired period; Ex. " 20.0 MIN".**
6. Press the PRGM key.	**Top line reads "LEAK TEST" and bottom line reads "CONFIGURE".**
7. Press the up arrow key once.	**Top line reads "LEAK TEST" and bottom line reads "PRGM TO START".**
8. Press the PRGM key.	**Top line displays MIN/MAX pressure values at left/right. Bottom line reads the current pressure value and units.** **At end of test period, top line displays the leak rate in units per minute. Bottom line shows the current pressure reading.**
9. Press the PRGM key to exit the Leak Test	**Returns to Measure Mode**

The "Auto Shut-Off" timer is disabled for Leak Test sessions. Be sure to end the session to re-enable the Auto Shut-Off timer.

Re-Calibration

The HHP360 can be re-calibrated in the field for zero, span, and linearity. The proper primary standards must be available prior to calibrating the unit. These standards should meet the accuracy requirements for your company or industry. The factory follows guidelines established by ANSI / NCSL Z540-1-1994 which requires that the primary standard be 4 times more accurate than the unit under test.

The re-calibration is not intended to replace the Factory Lab Calibration Procedure. It is intended to correct the curve fit if the actual sensor characteristics change slightly over time.

For sensors up to 200 PSI, a ±0.0015% of reading deadweight tester is recommended.

1-point (within upper 50% of Full Scale), 5-point (nominal values of 0%, 25%, 50%, 75% & 100% of Full Scale), and restore factory default re-calibration options are offered. For the 5-Point re-calibration, points 2, 3 and 4 can be adjusted within ±1% of reading around the nominal values. Point #5 can be adjusted within -1% of reading around nominal. Point #1 is fixed.
For example: for a 2000 inH2O sensor, Point # 2 (25%) can be edited form 495 to 505 inH2O. Point #5 (100%) can be edited from 1980 to 2000 inH2O.

The unit can only be re-calibrated if the calibration points are within 5 times the accuracy of the original factory calibration (e.g. @ 0.05% accuracy, the point limit is ±0.25% of Full Scale). If the re-calibration procedure generates a new value outside this limit the procedure will fail. In this case the unit would need to be returned to the factory for service.

Once a re-calibration has been performed (either 1-point or 5-point) the unit will continue to allow future re-calibrations only with that type of re-calibration. In order to enable the other re-calibration type, the user must first restore the re-calibration data to the factory defaults.

RE-CALIBRATION – 1 Point EDIT and START

To perform a 1-point re-calibration, apply a pressure between 50% and 100% of Full Scale and then follow these steps:

Keystroke	Display
1. With unit OFF, press and hold the MIN/MAX key, turn the unit on by pressing the ON/OFF key, then release MIN/MAX.	**Top line reads "RE-CAL". Bottom line reads "EDIT".**
2. Press the up arrow key until "START" is displayed on the bottom line.	**Top line reads "RE-CAL". Bottom line reads "START".**
3. Press the PRGM key.	**Top line reads "RE-CAL START". Bottom line reads "1-POINT".**
4. Press the PRGM key.	**Top line reads "CAL POINT" and bottom line displays the cal point value.**
5. Press the up/down arrow keys to edit the selected digit. Use the left/right arrow keys to change the cursor position. Value entered must be 50-100% of FS.	**Bottom line displays the cal point value. The cursor flashes at the first position while the value is changed, then moves to the right position when the right arrow key is pressed.**
6. Press the right arrow key while on the right most digit to proceed.	**Top line reads "APPLY:" Bottom line displays the "CAL POINT" value.**
7. Apply the input pressure indicated using an appropriate reference standard; press PRGM key.	**Top line reads "RE-CAL". Bottom line reads "START", Manometer has been recalibrated.**
8. Press the left arrow key.	**Returns to Measure Mode**

RE-CALIBRATION – 5 Point EDIT

To edit the calibration points for a 5 Point re-calibration follow the steps below.
NOTE: If the factory default values are acceptable, skip this section and proceed to the re-calibration 5-Point START procedure.

Keystroke	Display
1. With unit OFF, press and hold the MIN/MAX key, turn the unit on using the ON/OFF key, then release	**Top line reads "RE-CAL". Bottom line reads "EDIT".**
2. Press the PRGM key.	**Top line reads "CAL POINT 1". Bottom line displays the cal point value.**
3. Press the up/down arrow keys to edit the selected digit. Use the left/right arrow keys to change the cursor position. *Note: For 0% go directly to step 4.*	**Bottom line displays the cal point value. The cursor flashes at the first position while the value is changed, then moves to the right position when the right arrow key is pressed.**
4. Press the right arrow key while on the right most digit to proceed.	**Top line reads "CAL POINT 2". Bottom line displays the cal point value.**
5. Repeat steps 3 and 4 for CAL POINTS 2, 3, 4 and 5.	**Top line reads "CAL POINT 2/3/4/5". Bottom line displays the cal point value.**
6. After editing CAL POINT 5 press the right arrow key while on the right most digit to proceed.	**Top line reads "RE-CAL". Bottom line reads "EDIT".**
7. To perform the 5-point re-cal, press the up arrow key until START is displayed on the bottom line. **OR** **To exit without performing the 5-point re-cal press the left arrow key**	**Top line reads "RE-CAL". Bottom line, "START". Continue with 5-Point Re-calibration procedure at step 3 on next page.** **OR** **Returns to Measure Mode.**

RE-CALIBRATION – 5 Point START

To begin the 5-point re-calibration procedure, turn the unit OFF and follow the steps below.

Keystroke	Display
1. Press and hold the MIN/MAX key. Turn unit on using the ON/OFF key.	**Top line reads "RE-CAL". Bottom line reads "EDIT".**
2. Press the up arrow key until "START" is displayed on the bottom line.	**Top line reads "RE-CAL". Bottom line reads "START".**
3. Press the PRGM key.	**Top line reads "RE-CAL Bottom line reads "1-POINT".**
4. Press the up arrow key until "5-POINT" is displayed on the bottom line.	**Top line reads "RE-CAL START". Bottom line reads "5-POINT".**
5. Press the PRGM key.	**Top line reads "POINT 1 – ZERO:" Bottom line displays live applied pressure.**
6. Vent P1 and P2 ports to atmosphere and simultaneously press the MIN/MAX and HOLD keys, then release.	**Unit takes new zero. Top line reads " POINT 1 - ZERO:" Bottom line displays live applied pressure. POINT 1 has been taken.**
7. Press the right arrow key while on the right most digit to proceed.	**Top line reads "POINT 2 - APPLY:". Bottom line displays the cal point value to apply.**
8. Apply the indicated calibration point pressure using external pressure standards. After pressure is stable, press the right arrow key.	**Top line reads "POINT 3 - APPLY:". Bottom line displays the cal point value to apply.**
9. Repeat step 8 for CAL POINTS 4 and 5.	**Top line reads "POINT 4/5 - APPLY" Bottom line displays the cal point value.**
10. Use up or down arrow keys to select NO or YES when asked "Save?" the Re-Calibration data.	**Top line reads "SAVE?". Bottom line reads "NO" or "YES".**
11. Press the PRGM key at YES to save the Re-Calibration data or at NO to exit without saving.	**Top line reads "RE-CAL". Bottom line reads "START". Re-cal is complete.**
12. Press the left arrow key.	**Returns to Measure Mode.**

RE-CALIBRATION – Restore Factory Defaults

To restore the re-calibration data to the factory defaults, follow these steps:

Keystroke	Display
1. With unit OFF, press and hold the MIN/MAX key, turn the unit on using the ON/OFF key, then release.	**Top line reads "RE-CAL". Bottom line reads "EDIT".**
2. Press the up arrow key twice.	**Top line reads "RE-CAL". Bottom line reads "RESTORE DEFAULTS".**
3. Press the PRGM key.	**Top line reads "RESTORE DEFAULTS". Bottom reads "YES" or "NO".**
4. Use the up and down arrow keys to select YES or NO when asked to restore defaults.	**Top line reads "RESTORE DEFAULTS". Bottom reads "YES" or "NO".**
5. Press the PRGM key at YES to restore the Factory Default Calibration data or at NO to exit without restoring.	**Top line reads "RE-CAL". Bottom line reads "RESTORE DEFAULTS". Factory defaults have been restored.**
6. Press the left arrow key.	**Returns to Measure Mode.**

Specifications

Type, Range and Display Resolution: HHP360-A: 0 - 17.403 psia (0 - 900.00 mmHg) HHP360-B: 0 - 38.674 psia (0 - 2000.0 mmHg)
Accuracy: HHP360-A: 0017: ±0.02 % F.S. (F.S. = 900 mm Hg) HHP360-B: 0038: ±0.015 % F.S.* from 0-1000 mm Hg ±0.025% F.S.* from 1000-2000 mm Hg *F.S. = 2000 mm Hg Absolute Includes the combined effects of temperature, linearity, repeatability, hysteresis and resolution. Warm up time = 5 minutes.
Temperature: Storage = -40°C to +60°C (-40°F to +140°F) Operating = -20°C to +50°C (-4°F to +122°F)
Media Compatibility: AI: Absolute pressure sensors for use with gases and liquids compatible with 316L SS
Pressure Limits: AI units: 77 PSIA (4000 mm Hg Abs)
Connection: 1/8" female NPT, 316L SS. P1 is the pressure connection. P2 is not accessible (factory plugged with metal disc)   User must use a wrench on the pressure manifold when installing user's 1/8" NPT fitting. Do not tighten the fitting without using a wrench on the pressure manifold. Failure to use a wrench on the manifold will damage the plastic enclosure and void warranty No torque should be applied to the manifold with respect to plastic enclosure.
Battery Operation: >100 hours continuous use, 1 year shelf life, auto power off programmable at Disabled, 10, 20, 30, 60 or 90 minutes
Enclosure: (6.9" x 3.8" x 2.3") Polycarbonate, Permanently Static Dissipative, ESD Protection Enclosure with Boot: (7.2" x 4.2" x 2.5")

Certification/Safety/Warnings

The HHP360 is for general purpose use only.

Note the following **WARNINGS and requirements**:

- Substitution of components may impair operation
- Do not use or service in the presence of explosive atmospheres.
- Do not replace batteries in the presence of explosive atmospheres.
- User must use a wrench on the pressure manifold when installing user's 1/8" NPT fitting. Do not tighten the fitting without using a wrench on the pressure manifold. Failure to use a wrench on the manifold will damage the plastic enclosure and void warranty No torque should be applied to the to the plastic enclosure while installing 1/8" NPT fittings.

Changing the Batteries

Adherence to the Specifications and Certification/Safety/Warnings sections of this manual shall be enforced when changing batteries.

The manometer is powered by four, 1.5 volt AA size batteries. When the output of the batteries under load drops, the display will alternate between "LOW POWER DETECT" and "REPLACE BATTERY". Low power may affect performance. The unit should not be used to measure pressure in this condition. All four batteries should be replaced.

To replace the battery locate the battery compartment at the bottom rear of the manometer, as shown here.

Remove the two screws on either side of the battery cover by turning them counterclockwise until the fully disengaged from the manometer base. Lift the cover from the back of the unit.

Remove the batteries by pulling the positive side first straight out

of the battery compartment. Note the positive (+) and negative (-) battery polarity markings at the bottom of the compartment, as shown here.

To install the four batteries: 1) Make sure polarity of battery matches the markings in the compartment. 2) 1st place the (+) end of the battery into the bottom of the battery slot. 3) Then push in (-) end of the battery until it is seated in the bottom of the battery slot. The battery compartment has stand offs molded into the side of the compartment. When a battery is installed with the polarity reversed, the stand offs prevent the negative battery terminal from contacting the positive terminal in the battery compartment. The unit will not power up when a battery is installed this way. Should this happen, simply reverse the battery to align the polarity.

With the batteries secured in the battery compartment, replace the compartment cover. The cover has only one correct alignment. The "WARNING DO NOT OPEN IN EXPLOSIVE ATMOSPHERE" statement on the battery cover must be visible and aligned in the middle of the manometer case. To secure the cover, torque the screws clockwise to 1.6-1.8 in-lbs. Do not over tighten.

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of theproduct, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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- Pumps & Tubing
- Air, Soil & Water Monitors
- Industrial Water & Wastewater Treatment
- pH, Conductivity & Dissolved Oxygen Instruments

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